

19. Derive expressions for the electric and magnetic intensity for radiation from a centre fed half wave linear antenna. And hence show that its radiation resistance is 73.2 ohm.
20. Discuss propagation of ear wave 0 between two perfectly conducting plans.

NOVEMBER/DECEMBER 2024

**DPH22/GPH22 — ELECTROMAGNETIC
THEORY**

Time : Three hours

Maximum : 75 marks



SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

Calculate the work done in moving a charge once round a closed path in an electric field.

2. Define bound charge density in terms of polarization and hence define the electric displacement vector.
3. State Biot-Savart's law.
4. Show that the magnetic scalar potential satisfies the Laplace equation.
5. Write Maxwell's equations in integral form.
6. Give Lorentz and Coulomb gauge conditions.
7. Why half wave antenna is commonly used to radiate electromagnetic energy into space?
8. What is an antenna array?

9. Define skin depth.
10. What is a wave guide?

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) Obtain the solution to Laplace equation in Cartesian coordinate.

Or

- (b) Discuss molecular polarizability and electric susceptibility.

12. (a) Using Biot-Savart law, derive an expression for the magnetic induction at a distance from an infinitely long straight conductor carrying current.

Or

- (b) Obtain Ampere's law in differential form and integral form.

13. (a) Obtain the continuity equation for current density.

Or

- (b) Starting from Maxwell's equation $\text{curl } E = -\frac{\partial B}{\partial t}$ and $\text{curl } H = J + \frac{\partial D}{\partial t}$ respectively, show that $\text{div } B = 0$ and $\text{div } E = \rho$.

14. (a) Define an oscillating dipole and derive the expression for its scalar potential.

Or

- (b) Derive an expression for the resultant electric intensity due to an array.

15. (a) Show that the electromagnetic wave is damped inside the conducting medium.

Or

- (b) Discuss the reflection and refraction of electromagnetic waves at a plane interface.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Derive an expression for potential and field at a point inside and outside the dielectric sphere placed in a uniform electric field.

17. Deduce an expression for (a) magnetic scalar potential and (b) magnetic vector potential.

18. What is Lorentz force? Express Lorentz force in terms of scalar and vector potentials.

